

What is claimed is:

1 1. A method of determining alignment between the wheels of a vehicle using a
2 position determination system, comprising the steps of:

3 indicating wheel positions on the vehicle with targets;

4 imaging the targets to obtain locations of the wheel positions; and

5 calculating a relationship between the front and rear wheels.

1 2. The method according to claim 1, further comprising the steps of:

2 calculating a front wheel track, the front wheel track being defined between the locations
3 of the two front wheels; and

4 calculating a rear wheel track, the rear wheel track being defined between the locations of
5 the two rear wheels.

Sub 1
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4 3. The method according to claim 2, wherein the step of calculating the relationship
1 between the front and rear wheels includes comparing an angle between the calculated front
2 wheel track and the calculated rear track to a specified range for the angle between the calculated
3 front wheel track and the calculated rear track.

1 4. The method according to claim 2, wherein the step of calculating the relationship
2 between the front and rear wheels includes comparing the calculated front wheel track to a
3 specified range for the front wheel track and comparing the calculated rear wheel track to a
4 specified range for the rear wheel track.

1 5. The method according to claim 2, further comprising the steps of:

2 calculating a right wheel base, the right wheel base being defined as the distance of a line
3 passing adjacent one of the right wheels and perpendicularly from the wheel track passing
4 through the one of the right wheels to the wheel track passing through the other of the right
5 wheels; and

6 calculating a left wheel base, the left wheel base being defined as the distance of a line
7 passing adjacent one of the left wheels and perpendicularly from the wheel track passing through
8 the one of the left wheels to the wheel track passing through the other of the left wheels.

Sub A-6
6. The method according to claim 5, wherein the step of calculating the relationship
between the front and rear wheels includes comparing the calculated right wheel base to a
specified range for the right wheel base and comparing the calculated left wheel base to a
specified range for the left wheel base.

7. The method according to claim 1, further comprising the steps of:
calculating a right wheel base, the right wheel base being defined between the locations
of the two right wheels; and
calculating a left wheel base, the left wheel base being defined between the locations of
the two left wheels.

Sub A-7
8. The method according to claim 7, wherein the step of calculating the relationship
between the front and rear wheels includes comparing the calculated right wheel base to a
specified range for the right wheel base and comparing the calculated left wheel base to a
specified range for the left wheel base.

9. The method according to claim 2, further comprising the steps of:

2 calculating a front center point of the front wheel track;
3 calculating a rear center point of the rear wheel track;
4 defining a line originating from the center point of one of the front and rear wheel tracks
5 and perpendicular thereto and intersecting the other of the front and rear wheel tracks; and
6 calculating an offset distance from the intersection of the line with the other of the front
7 and rear wheel tracks to the center point of the other of the front and wheel tracks.

1 10. The method according to claim 9, wherein the step of calculating the relationship
2 between the front and rear wheels includes comparing the calculated offset distance to a
3 specified range for offset distance.

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3 range for the first diagonal and comparing the calculated second diagonal to a specified range for
4 the second diagonal.

1 14. The method according to claim 11, further comprising the steps of:
2 calculating a first skew angle, the first skew angle being defined as the angle between the
3 first diagonal and one of the wheel tracks; and
4 calculating a second skew angle, the second skew angle being defined as the angle
5 between the second diagonal and the other of the wheel tracks.

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2 15. The method according to claim 14, wherein the step of calculating the relationship
3 between the front and rear wheels includes calculating a difference between the first skew angle
4 and the second skew angle and comparing the calculated difference between the first skew angle
5 and the second skew angle to a specified range for difference between the first skew angle and
the second skew angle.

1 16. The method according to claim 14, wherein the step of calculating the relationship
2 between the front and rear wheels includes comparing the calculated first skew angle to a
3 specified range for the first skew angle and comparing the calculated second skew angle to a
4 specified range for the second skew angle.

1 17. A computer-implemented position determination system for determining
2 alignment between the wheels of a vehicle, comprising:
3 one or more targets for indicating wheels positions on the vehicle; and
4 a vision imaging system for imaging the targets to obtain locations of the wheel positions
5 and for calculating a relationship between the front and rear wheels of the vehicle.

1 18. The system according to claim 17, wherein the vision imaging system calculates a
2 front wheel track and a rear wheel track with the front wheel track being defined between the
3 locations of the two front wheels and the rear wheel track being defined between the locations of
4 the two rear wheels.

Sub A
1 19. The system according to claim 18, the calculation of the relationship between the
2 front and rear wheels includes comparing an angle between the calculated front wheel track and
3 the calculated rear track to a specified range for the angle between the calculated front wheel
4 track and the calculated rear track.

Sub B
1 20. The system according to claim 17, the calculation of the relationship between the
2 front and rear wheels includes comparing the calculated front wheel track to a specified range for
3 the front wheel track and comparing the calculated rear wheel track to a specified range for the
4 rear wheel track.

1 21. The system according to claim 18, wherein the vision imaging system calculates a
2 right wheel base and a left wheel base with the right wheel base being defined as the distance of
3 a line passing adjacent one of the right wheels and perpendicularly from the wheel track passing
4 through the one of the right wheels to the wheel track passing through the other of the right
5 wheels and the left wheel base being defined as the distance of a line passing adjacent one of the
6 left wheels and perpendicularly from the wheel track passing through the one of the left wheels
7 to the wheel track passing through the other of the left wheels.

Sub AH BF
22. The system according to claim 21, wherein the calculation of the relationship
2 between the front and rear wheels includes comparing the calculated right wheel base to a
3 specified range for the right wheel base and comparing the calculated left wheel base to a
4 specified range for the left wheel base.

23. The system according to claim 17, wherein the vision imaging system calculates a
2 right wheel base and a left wheel base with the right wheel base being defined between the
3 locations of the two right wheels and the left wheel base being defined between the locations of
4 the two left wheels.

Sub AH BF
24. The system according to claim 23, wherein the calculation of the relationship
2 between the front and rear wheels includes comparing the calculated right wheel base to a
3 specified range for the right wheel base and comparing the calculated left wheel base to a
4 specified range for the left wheel base.

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25. The system according to claim 18, wherein the vision imaging system:
2 calculates a front center point of the front wheel track and a rear center point of the rear
3 wheel track;
4 defines a line originating from the center point of one of the front and rear wheel tracks
5 and perpendicular thereto and intersecting the other of the front and rear wheel tracks; and
6 calculates an offset distance from the intersection of the line with the other of the front
7 and rear wheel tracks to the center point of the other of the front and wheel tracks.

1 26. The system according to claim 25, wherein the calculation of the relationship
2 between the front and rear wheels includes comparing the calculated offset distance to a
3 specified range for offset distance.

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27. The system according to claim 17, wherein the vision imaging system calculates a
first diagonal and a second diagonal with the first diagonal being defined between the locations
3 of the right, front wheel and the left, rear wheel and the second diagonal being defined between
4 the locations of left, front wheel and the right, rear wheel.

1 28. The system according to claim 27, wherein the calculation of the relationship
2 between the front and rear wheels includes calculating a difference between the first diagonal
3 and the second diagonal and comparing the calculated difference between the first diagonal and
4 the second diagonal to a specified range for difference between the first diagonal and the second
5 diagonal.

1 29. The system according to claim 27, wherein the calculation of the relationship
2 between the front and rear wheels includes comparing the calculated first diagonal to a specified
3 range for the first diagonal and comparing the calculated second diagonal to a specified range for
4 the second diagonal.

1 30. The system according to claim 27, wherein the vision imaging system calculates a
2 first skew angle and a second skew angle with the first skew angle being defined as the angle
3 between the first diagonal and one of the wheel tracks and the second skew angle being defined
4 as the angle between the second diagonal and the other of the wheel tracks.

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31. The system according to claim 30, wherein the calculation of the relationship
3 between the front and rear wheels includes calculating a difference between the first skew angle
4 and the second skew angle and comparing the calculated difference between the first skew angle
5 and the second skew angle to a specified range for difference between the first skew angle and
the second skew angle.

1 32. The system according to claim 30, wherein the calculation of the relationship
2 between the front and rear wheels includes comparing the calculated first skew angle to a
3 specified range for the first skew angle and comparing the calculated second skew angle to a
4 specified range for the second skew angle.

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